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"PREVELANCE OF NECK AND SHOULDER POSTURE ABNORMALITIES FOLLOWING CORONARY ARTERY BYPASS GRAFT SURGERY"

Physiotherapy

KEYWORDS: Craniovertebral angle, high thoracic angle, head postural spinal curvature instrument, coronary artery disease, and posture.

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ABSTRACT

Background: Postural abnormalities such as forward shoulder and forward head posture are believed to be present following coronary artery bypass graft (CABG) due to median sternotomy. Till now, no study has been done and published in India which states the presence of postural disorders after CABG surgery. **Objective:** To determine the prevalence of forward neck or forward shoulder posture after CABG surgery and to explore the associated complications. **Materials and methods:** In this cross-sectional prospective survey, 54 postoperative CABG patients were recruited. Details regarding demographic data, operative data, peri-operative data, and duration of ICU stay were collected. Two angles were measured namely craniovertebral and high thoracic for forward head and forward shoulder respectively pre and post-CABG. The angles were measured by head postural spinal curvature instrument (HPSCI). Results: The prevalence of forward head and forward shoulder both found to be statistically significant in post-CABG patients. No significant association was found between age, gender and occupation. **Conclusion:** The research found concluded that there is significant relation between postural abnormalities and post cardiac surgery patients. The paper concludes by expecting for further research to explore and develop more directed prophylactic exercise regime for musculoskeletal complications following cardiac surgery (CABG).

Introduction

According to World Health Organization (WHO) the prevalence of neck pain and postural abnormalities is not the same throughout the world. The prevalence of postural abnormalities in western countries and Asian countries was reported between 35-54 % and 64% respectively[1]. The current scenario of postural abnormalities in India is more than 32 million patients. The posture is defined as the attitude assumed by the body with support during muscular inactivity or by coordinated actions of many muscles to maintain a proper stability. There are two patterns of posture: good and bad posture. A posture is said to be poor when muscles fail to serve the purpose for which it is designed to be or unnecessary amount of muscle work is happening in order to maintain the postural stability. Upper cross syndrome can be described as a muscular imbalance at neck and shoulder region. It is due to over activity of the upper trapezius, levator scapulae, sternocleidomastoid and pectoralis muscles and the reversal weakness and lengthening of the deep cervical flexors, lower trapezius and serratus anterior[2]. This imbalance of the muscles at the neck and shoulder region will cause the postural deviations and movement dysfunction for the individuals. Coronary artery bypass graft (CABG) was first performed in India in the year 1975. In recent years, almost 60,000 surgeries are carries out in India per year. This is because of increasing numbers of coronary artery disease cases in India. The major cause behind this increase is the rapid unplanned urbanization taking place among traditional societies, which led to a lifestyle involving reduction in physical activity, smoking and unhealthy nutrition. The risk factors for CAD could be obesity, hyperlipidemia, diabetes mellitus, hypertension and age-related degenerative changes[2]. Median sternotomy is performed through skin incision which is carries out two or three inches below the xiphoid process. The incision made causes excision of the anterior chest muscles. The brachial plexus which is anatomically structured behind the thorax also gets into the picture during median sternotomy. This causes injury mostly to the C8 and T1 nerve trunk. All this peri-operative factors causes many musculoskeletal complications after the cardiopulmonary bypass surgery. The main area of concern goes towards the postural deviation of head, neck and the shoulder post-surgery. Because o the insertion of the central venous catheter the internal jugular vein gets injured due to piercing of the needle post-surgery when the patients are in the intensive care unit. This causes pain at the neck region hence the patients attains a certain protective posture in order to overcome the pain. This might cause the tautness of the extensor cervical muscles and lengthening of the deep flexor muscle. The cervical spine becomes instable and goes into forward head position due to this mal-alignment[3]. Median sternotomy causes severe pain during immediate postoperative period which again causes the patients to sustain slouched posture in response to the protection of the pain. The sustained slouched posture causes dysfunction in the shoulder and thorax region[3]. Also due to the pain caused by the intercostal drain insertion post-operatively at the anterior chest region which forces the patients to attain a bad posture[4]. As there is sternal retraction on the joints and soft tissues of thorax after median sternotomy the neck and shoulder normal functions are grossly hampered[4]. Despite increase percentage of musculoskeletal dysfunction in post-CABG patients, the number of studies performed in this field are very less. With growing number of CAD there is also a mark increase in the CABG surgery which hints us towards the growing number of musculoskeletal dysfunction associated to it. Therefore, this study had been conducted with primary goal to state the prevalence of shoulder and neck dysfunction among post-CABG patients and to evaluate the relationship between selected subjects and prevalence of shoulder and neck dysfunction.

Materials and methods:

Study design: A cross-sectional, prospective study was carried out to evaluate the prevalence of forward neck and forward shoulder posture among post-operative CABG patients and also determine the association between selected subjects and prevalence of postural dysfunction. The study design was on assessment basis. Fifty-four post-operative CABG patients were recruited from Narayana Hridayalaya multispecialty hospital in Dharwad, Karnataka. The study was carried out in the cardiology department ward of the above hospital. The objectives and methods of the study were clearly explained to the subjects and were asked to sign a informed consent. Study protocol was reviewed and approved by the Sri Dharmasthala Manjunatheshwara ethics committee board.

Subjects were included in the study only if they underwent CABG via median sternotomy with a minimum post-operative period of five to twenty days.

Instrument:

This research required an instrument to measure two angles for

forward head and forward shoulder posture. The instrument used was head postural spinal curvature instrument[1] to measure the craniovertebral angle for forward head posture and high thoracic angle for forward shoulder posture. The craniovertebral angle was measured by a horizontal line from C7 spine and a diagonal line from the tragus of the ear. The high thoracic angle was measured by a horizontal line from C7 spinous process and a diagonal line from the mid-point of the acromion process. Skin markers were used for marking the points. A proper mega-pixel camera was used to assess for the angulation. Pictures were taken from a distance of 3 inches from the patient. The normal Craniovertebral angle is 46 degrees. Normal high thoracic angle is 53 degrees. The smaller the angle value the more is the deviations in the posture[5]. Pre-CABG and post-CABG angle values were measured.

Participants:A total of 54 subjects satisfying the selection criteria were recruited for the study. After obtaining the informed consent and collecting the pre-CABG and post-CABG angle values data collection sheet was tabulated in the Microsoft excel sheet.

Statistical analysis:
Descriptive statistics was calculated for demographic data, operative data, pre-and post-operative craniovertebral and high thoracic angles and prevalence of the forward head and forward shoulder posture. The results were calculated through one-way ANOVA and Karl Pearson Smirnoff test. 5% level of probability was used to evaluate statistical significance.

Results:
During a course of 5 months (September 2016 to January 2017), a total of 70 patients underwent CABG at the NH multispecialty hospital. Out of 70 patients, 5 patients experienced death and 11 patients were excluded due to language barrier. Hence a total of 54 patients were recruited for this study. Patients were consented for this study in the cardiac ward and if they met the inclusion criteria angles were measured pre-CABG and post-CABG of the same patients after they discharged from the ICU. Demographic data of 54 subject's age wise are presented in table no 1. Maximum number of participants belonged to the age of 51 or less (less limit being 40years). The percentage of this range is 38.89%. This followed by the age group of 51-60 years of age range. The percentage being 31.48%.

Table 1: Distribution of patients by age groups

Age groups	No of patients	% of patients
<=50yrs	21	38.89
51-60yrs	17	31.48
>=61yrs	16	29.63
Total	54	100.00
Mean	55.93	
SD	8.43	

Table 2: Describes the patients according to the distribution by gender wise. The table shows more number of male subjects that 61.11% (33 out of 54 patients).

Gender	No of patients	% of patients
Male	33	61.11
Female	21	38.89
Total	54	100.00

Table no.3: Distribution of patients by no. of arteries involved

No. of arteries involved	No of patients	% of patients
Two	9	16.67
Three	45	83.33
Total	54	100.00

Table no.4: Comparison of pretest and posttest time points with CV and HT scores by paired t test

Variables	Time points	Mean	Std.Dv.	Mean Diff.	SD Diff.	% of change	Paired t	p-value
CV	Pretest	44.70	2.00					
	Posttest	43.24	2.31	1.46	1.92	3.27	5.5986	0.0001*
HT	Pretest	52.69	1.49					
	Posttest	51.30	1.55	1.39	1.58	2.64	6.4469	0.0001*

*p<0.05

Discussion: The purpose of this study was to observe the prevalence of forward head and forward shoulder posture in the patients who underwent coronary bypass graft surgery- a cross-sectional randomized controlled trial. This study showed the results of values of two angles that is cranio-vertebral angle and high thoracic angle for forward head and forward shoulder posture respectively. The values of both the angles were measured pre-surgery and post-surgery and the difference were compared.In our study there were total 54 subjects who were randomly allocated for this experimental study. In this study we had included age group of 40 to 70 years of age. We had included age group because the prevalence of coronary artery disease is high after the age group of 45 and above. As shown in table no.1 and figure no.1, we had distributed patients ranging from 50 or less, the second group from 51-60 years of age and the third group from 60 years or above. Many studies have shown that the quality of the life after the coronary artery bypass surgery is improved and effective in the age group of 45-55years. Quality of life in the elderly patients that is above 70 years, after the CABG does not show significant improvement. In our study the maximum subjects falling in the age group was ranging from 40-50years that is 38.89%.One study had also been performed which states that as the age progresses, the chances of degeneration of the musculoskeletal system also sets in6. Postural deviation is one of the most common degenerative musculoskeletal problems. In our study most of the subjects are from the age group of 50 years or less. Hence postural abnormality will be merely seen in such patients. So the effect of coronary artery bypass graft on the cervical and shoulder posture will be purely differentiated in our study as the age group found of the patients was favorable enough to the study plot.

Table no.2 and figure no.2 shows the distribution of the subjects according to the gender. Out of 54 subjects, 33 subjects were males (61.11%) and 21 subjects were females (38.89%). Males are more commonly affected than females as the risk factors of the coronary artery disease is more commonly prevailed in males than in females[7]. The modifiable risk factors such as smoking, obesity, stress, alcohol consumption was found more common in males than in compared to females. Females show high risk factors after the menopausal age. Obesity is the severe complication of post-menopausal women hence the risk towards the coronary artery disease increases. According to the recent study done by the American heart association in 2015 states that males have more prevalence of coronary heart disease than females. According to the study the mean value of the males affected by coronary artery disease is 6.3 and females were 5.6.

Table no.3 and figure no.3 shows the distribution of the patients according to the number of arteries involved in the subjects who were the known cases of coronary artery disease. The number of arteries involved was categorized into two arteries involved and three arteries involved. The subjects involved with two arteries were 9 out of 54 and the mean score was 16.67. The subjects involved with three arteries were 45 out of 54 and the mean valve was 83.33. The subjects with two arteries involved was diagnosed as the case of double vessel disease (DVD) and the subjects with three arteries involved were diagnosed as the case of triple vessel disease (TVD). The subjects with more number of arteries involved were engaged in more long-standing hours of coronary artery bypass graft surgical procedure than the subjects with less number of arteries involved. Hence the risk of peri-operative complications increases during more long-standing hours of surgical procedure. This peri-operative complication may lead to most often post-operative complications. The most frequent post-operative complication is related to pulmonary and musculoskeletal systems.

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Table no.4 and figure no.4 states the comparison of pre-CABG values and post-CABG values of craniovertebral angle and high thoracic angle scores by paired t test. It showed that there is a significant improvement in the values of craniovertebral angle and high thoracic angle when the pre and post-surgery scores were compared. The mean values of craniovertebral angle pre-surgery were 44.7 (normal angle range from 45-47 degrees). The mean values of the craniovertebral angle post-surgery were 43.2 degrees. The mean difference calculated was 1.46. The percentage of change was noted as 3.27%. The p value showed that the score was highly significant with the p-value being 0.0001. The mean values of high thoracic angle pre-surgery were 52.6 (normal angle range from 53-54 degrees). The mean values of the high thoracic angle post-surgery were 51.3 degrees. The mean difference calculated was 1.39. The percentage of change was noted as 2.64%. The p value showed that the score of high thoracic angle was highly significant with the value of 0.0001.

In our study, craniovertebral angle and high thoracic angle were taken as the two outcome measures to evaluate the prevalence of the forward head and forward shoulder posture post coronary bypass graft. As there is increase in the frequency of CABG surgeries being performed in India, there are many musculoskeletal problems, particularly postural deviations in post-CABG patients.

A study done in the year 2011 states that patients with forward neck posture and chronic neck pain present dysfunction of their respiratory system which can be mainly manifested as respiratory distress or hypocapnia. Pain intensity, neck muscle fatigue, and kinesiophobia seem to be the most important deficits predisposing to this respiratory dysfunction. Due to faulty head and shoulder posture there are changes in rib cage bio mechanism which leads to alterations in the respiratory pattern.

Conclusion:

The result showed that there was a statistical correlation between the post-CABG patients and the craniovertebral and high thoracic angle. No significant association was found between age, gender and occupation. After high prevalence of postural deviation steps should be taken to change the stereotype post-operative care protocol and focus on the musculoskeletal problems post-CABG by the physical therapist. This care should be taken in immediate post-operative period and continue same following discharge from the hospital. Screening and evaluation of these post-operative problems should be carried out.

List of abbreviations used:

CAD: coronary artery disease.
CABG: coronary artery bypass graft.
CV angle: craniovertebral angle.
HT angle: high thoracic angle
HPSCI: head postural spinal curvature instrument.
DVD: double vessel disease.
TVD: triple vessel disease.
NH: Narayana Hridayalaya
Competing interest: No competing interest was used in this study.

Author's contribution:

Intellectual and idea of the study contributed by the first author.
Design of the study suggested by the first author. Data collection and material collection done by the second author.

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Recommendation: We found that none of the patients attended cardiopulmonary rebalititation sessions after CABG. This is attributed to lack of education regarding cardiac rehabilitation provided to the patient. A many number of studies among Indian publications have published results in favor of the cardiac rehabilitation post-operatively. We suggest the patients to indulge in more sessions of post-operative care of both the musculoskeletal and cardio-respiratory system to lead a good quality of life.

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